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TOPOGRAPHIC SURVEYS IN THE UNITED STATES.

BY

H. M. WILSON.

A conference held recently in Washington between Messrs. Henry Gannett, geographer of the United States Geological Survey, Frank Bond, chief draftsman of the General Land Office, and Charles S. Sloane, geographer of the Census, resulted in the careful perusal of official records or areas of the various States and Territories of the United States, and of the latter as a whole. The result has been the adoption of areas for each which will doubtless be accepted as authentic until the topographic survey of the total area of the United States shall have been completed. Of the newly-accepted area of the United States, 3,026,789 square miles, the United States Geological Survey has completed topographic maps of about 1,025,000 square miles, or a little over one-third of the total area. Of this a large proportion has been mapped only in a reconnaissance way, on the small scale of about four miles to one inch and with a contour interval of 200 ft. Also, a large portion of the work done prior to 1890, on the scale of two miles to one inch, is of reconnaissance character, lacking as it does the spirit levelling necessary to render the results at all final. It is therefore evident that the work of making a topographic map of the whole United States is yet far from completed in spite of the really rapid progress being made.

Annually for several years past the United States Geological Survery has averaged about 35,000 miles of completed topographic surveying. This is equal to the annual mapping of a state nearly the size of Indiana, and greater than Maine or South Carolina. It is an area nearly equal that of Portugal and as great as that of Switzerland and Denmark combined, yet it is scarce one one-hundredth of the total area of the United States exclusive of Alaska. The total appropriation to these topographic surveys is $350,000 per annum and the cost has for the last few years averaged about $10 per square mile, exclusive of the more detailed work done in such States as have co-operation, where larger scale maps are made and more work is done to an amount about equal to the financial contribution from such co-operation States.

The topographic mapping of the States of Connecticut, Massachusetts, New Jersey, and Rhode Island has been completed; that of West Virginia will have been completed at the close of this year; that of some of the other States is rapidly approaching completion. The exact area of these States is now known, that of Connecticut being 5,047.24 square miles, of Massachusetts 8,331.50 square miles, of New Jersey 7,886, and of Rhode Island 1,130.85. These areas include what is classed as land area only, excluding large bodies of water bordering on natural boundaries or the open ocean, but including all rivers and the smaller lakes, following the shore-line and jumping only from head-land to head-land, across necks or straits less than 1,000 ft. in width; thus, in Connecticut that portion of the State line within Long Island Sound is excluded.

In recent years the appropriations made by Congress for topographic surveys by the United States Geological Survey have been helped out in a number of States where co-operation has been had through legislative enactment. In such States as those enumerated, larger amounts of Federal funds have been expended for a few years, thus expediting the completion of the mapping of their areas. The consequent result has been to retard work temporarily in non-co-operating States, but upon the completion of work in co-operating States to free larger sums for expenditure elsewhere. At present the Federal Survey is co-operating with about sixteen States, chiefly through State Geologists, and in such wise that the results of the topographic mapping credit clearly in the titles on the maps the State co-operation. The results are available to the States for the prosecution of their economic studies, at the same time that they are available to the United States for its more general work of geologic mapping, soil surveys, military uses, and for the study of forestry and hydrographic resources.

In the eastern portion of the United States during the past season work was pushed with especial vigour in the States of Ohio, Pennsylvania, Illinois, West Virginia, Kentucky and New York, where liberal appropriations toward co-operation were available. The results of the season may be summarized as follows:

In Alabama a portion of the reconnaissance map about Bessemer was replaced by detailed topographic mapping of an area of about 250 square miles, chiefly in Shelby County. The results of this work will be of great assistance to the State Geologist in connection with his studies of the iron and coal deposits contiguous to Birmingham and Bessemer, as well as the extensive steel industries of that important region. Near the Georgia line the Opelika quadrangle has been mapped, covering an area of new survey aggregating about 800 square miles in Alabama in the counties of Chambers and Lee, and

200 square miles in Georgia. The results of this work will be useful not only to the State Geological Survey but also to investors in both States, and especially to the city of Columbus, Georgia, where there is great interest in the development of the water power of the Chattahoochee River.

In Georgia, in addition to the work on the Opelika quadrangle, an area of about 250 square miles was surveyed in detail over portions of the old reconnaissance map of Cartersville, chiefly in Bartow and Cherokee Counties. The results of this work will be used in studying the iron and other valuable mineral deposits near Cartersville. A beginning was made in Muscogee County of the survey of the Columbus quadrangle.

In Illinois, in co-operation with the Director of the State Geological Survey, Dr. H. Foster Bain, several areas of importance were mapped. An atlas sheet of about 200 square miles near Waukegan in Lake County was surveyed, the results of which are especially desired for educational purposes by the University at Evansville. For like reasons an area of about 250 square miles was surveyed about Wheaton, covering the larger unmapped portion of Dupage County. West of Springfield an equal area was mapped to be utilized by the State Survey in the study of the extension of the coal fields of that region. For like reasons and in connection with the study of the extension southwestward of the south-central coal body of Illinois, areas of 250 square miles each were mapped about Galatia, chiefly in Saline County, and Breese in Clinton County. A beginning was made in the mapping of areas in northwestern Illinois about Galena, where the State Geologist is interested in the study of the important mineral resources of the region. A large amount of important preliminary work was done in the State, chiefly the determination of geodetic positions by primary traverse, and an extension of the precise level net by the running of a line north and south near the eastern edge of the State, so that now, in conjunction with the precise levels run heretofore by the Army engineers on the Mississippi and Illinois Rivers and by the Coast Survey, the State of Illinois is well gridironed with lines of precise levels which will be useful in reducing future elevations to mean sea-level. Another line of precise levels was run from near Olney, eastward across the southern end of the State to Shawneetown.

In Indiana a beginning was made on the topographic survey of important new areas about Bloomington and Saline City. The former was made chiefly at the instance of the officials of the University of Indiana, and will produce a valuable base map for the study of the important oölitic limestone deposits found there, and the latter will be found useful by the State Geologist in connection with studies of the coal deposits of southwestern Indiana. A line of precise levels was run from the Coast Survey bench mark south of Bloomington, through Terre Haute to connect with the system in Illinois near Danville.

Surveys were continued in Iowa, consisting chiefly in the mapping of an area of 225 square miles, west of Des Moines. This will be utilized by the State and Federal Surveys in the study of the coal of that region.

In the neighbourhood of Leavenworth, Kansas, and chiefly in the interests of the Army School of Instruction at Ft. Leavenworth, topographic surveying was commenced on the large scale of three inches to one mile of an area of about 400 square miles. This includes the Government military reservation at Ft. Leavenworth, and will be utilized in instruction in military tactics, engineering and surveying by the Army School.

In Kentucky topographic mapping was prosecuted with some vigour in co-operation with the State Geologist, Dr. G. J. Norwood. The State Geological Survey was especially desirous of procuring base maps on which to study some of the more important problems connected with the coal, oil and fluorspar deposits of the State. To this end an area of about 150 square miles was mapped in western Kentucky, chiefly in Webster and Hopkins Counties. An equal area was mapped in southwestern Kentucky, near Monticello, and areas of 250 square miles each were mapped in the celebrated Blue-grass region near Lexington, Georgetown, Frankfort and Owenton. In addition a large amount of preliminary work was done, including the determining of geodetic positions by primary traverse and triangulation and the running of a line of precise levels from Winchester southeast into the celebrated feudal region in Breathitt County. This is in connection with the proposed re-survey in more detail of the old reconnaissance mapwork where the development of coal, oil and gas is now so active.

In Louisiana the topographic map of 250 square miles in Winn County is approaching completion. This work is being executed in co-operation with State Geologist G. D. Harris, who is greatly interested in the results in connection with important studies of economic problems. The resulting base map will also be utilized by the Bureau of Soils of the Department of Agriculture in the study of the soil qualities of this region.

In Maine an area of 300 square miles was mapped about the important industrial centres of Lewiston and Auburn, and including the noted health resort at Portland Springs. This work was done in co-operation with the State Survey Commission, of which Prof. Leslie A. Lee is chairman, and at whose instance preliminary work was extended over an area of 500 square miles in western Maine in the neighbourhood of Fryeburg. In addition to this an important line of precise levels was run from near Portland to Fryeburg, which line was extended across New Hampshire to the Connecticut River, where connection was made with a similar line run a few years ago from Portsmouth *via* Manchester and Concord across New Hampshire. The result of these lines of precise levels has been to bring sea-level elevations into all the southern and central portions of New Hampshire and into eastern Vermont. In addition to work executed in the last two or three years such levels have been extended up to the Androscoggin and Penobscot Rivers in Maine, well toward the headwaters. These are found to be of the greatest utility in connection with studies of water power of these streams.

In New Hampshire and Vermont an area of about 250 square miles was surveyed in the neighbourhood of Hanover, chiefly in the interest of Dartmouth College, which will utilize the results in educational work. A beginning was made at the instance of the State Bureau of Forestry of New Hampshire in the survey of an area of about 500 square miles about Winnepesaukee and Squam Lakes. This map will not only be useful in connection with the study of forestry problems, but to thousands of persons who resort to this region each summer.

In Maryland co-operation was continued with State Geologist William B. Clarke, and resulted in the survey of two areas of about 250 square miles each. These consisted of more detailed topographic mapping over the earlier reconnaissance areas about Laurel and Rockville. The first is of especial interest because of its proximity to Baltimore, where good road improvements are being rapidly extended, and the second because of its proximity to Washington, the Rockville sheet bordering the Washington sheet on the north. Preliminary work was also done looking to the extension of these surveys between Washington and Frederick.

In Michigan an area of about 500 square miles was mapped in much detail in the neighbourhood of Pontiac and Rochester, while a large amount of preliminary work was done immediately west thereof. This work was executed in co-operation with, and at the request of, Dr. Alfred C. Lane, State Geologist, and will be utilized not only in the study of economic and geologic problems, but especially in connection with studies of the old lake beaches and of the interesting morainal deposits covering a portion of this region.

Some of the most interesting topographic mapping of the past season was executed in northern Minnesota, just northeast of Crookston and northwest of Red Lake. This work was executed chiefly with the view to furnishing data upon which to study problems of draining the swamp lands, included within the area of the ceded Chippewa Indian reserve in Minnesota. This whole region is exceedingly level, the slope averaging about 1 ft. to the mile, and being quite uniform. It is covered with great areas of swamp and bog, and as it is quite open and the land an extremely rich, sandy loam, will furnish some of the best agricultural lands in the country when drained. The Red Lake, which is included within this area, is a double lake consisting of two elliptical bodies of water joined by a narrow pass. An area of about 500 square miles was covered with lines of spirit-levelling run with great accuracy, and topographic mapping was extended over a large portion of this area. Elsewhere in Minnesota preliminary work for topographic mapping was pushed with some vigour northwest of Minneapolis in Wright County and in southeastern Minnesota in Winona County.

In Mississippi an area of about 250 square miles was surveyed just south of Jackson, the results of which will be useful in connection with studies of the clay and cement materials of the State.

In Missouri a large amount of topographic mapping was executed, an area of about 400 square miles being mapped in the southwestern corner of the State just south of Joplin, the results to be utilized in the study of the extension of the mineral deposits of the Joplin district. In northeastern Missouri an area of about 250 square miles was mapped, chiefly in Macon and Shelby Counties. In addition quite an area of topographic mapping was completed in Platte County in connection with a topographic survey of the Ft. Leavenworth, Kansas, quadrangle.

A little topographic mapping of an important area was completed in northern New Jersey. This work is in the neighbourhood of Port Jervis, and is important because it practically completes the survey of the small unmapped corner of New Jersey lying in north Sussex County. A considerable amount of revision work was done in the neighbourhood of Greenwood Lake, bringing the topography of that region up to date chiefly in matters of culture.

In New York topographic work was done in co-operation with Henry Van Alstyne, State Engineer. An area of about 220 square miles was completed about Loon Lake in the Adirondacks, and an equal area about Potsdam in St. Lawrence County. Areas of 225 square miles each were mapped near Port Jervis and Goshen, chiefly in Orange and Sullivan Counties. In addition a large amount of preliminary mapping was extended over portions of Oswego County about Cooperstown, and in Delaware and Ulster Counties about Neversink.

In eastern North Carolina co-operation was had with the State Geologist, Dr. Joseph Hyde Pratt, and S. L. Patterson, Commissioner of Agriculture. The results of the season's work included the topographic mapping of areas of about 250 square miles each in Gates and Hertford Counties, and an equal area in Johnston and Sampson Counties. In addition, a large amount of preliminary map work was extended to the neighbourhood of Clinton in Sampson County.

In North Dakota some preliminary work was executed in the extreme western edge of the sheet, near Williston. This work will be utilized in connection with the study of the important lignite deposits along the Missouri River.

The greatest amount of topographic mapping executed in any one State was in Ohio, where liberal appropriations had been made for the extension of co-operative topographic surveys under the direction of the Governor, who was immediately represented by Prof. C. E. Sherman of the State University, as State Inspector of Surveys. In all, seventeen atlas sheets of 225 square miles each were completely mapped, and an equal area of country was covered with preliminary work of road traverse, levelling, etc., the gross area mapped exceeding 3,000 square miles. This work was generally distributed through the State, and was so placed as to meet the needs of the officials for accurate map information upon which to base studies of the mineral resources and other economic problems.

In Pennsylvania a large area of topographic mapping was completed in co-operation with the State Survey Commission. This work includes the complete mapping of six atlas sheets of about 225 square miles each, and of an equal area of preliminary mapping of roads, running of levels, etc. A portion of the work was in southeastern Pennsylvania, in the neighbourhood of Harrisburg and of Gettysburg. The larger part of it was in western Pennsylvania, where problems connected with the development of coal, oil, and gas resources await solution.

In South Carolina an area of about 250 square miles was mapped in York and Cherokee Counties and in the neighbourhood of Kings Mountain, North Carolina. This work will be utilized in studies of the extension of the tin deposits known to exist in this region.

In Tennessee an area of about 250 square miles in the Cumberland Plateau, east of Murfreesboro, was surveyed. Preliminary road traverse and levels were run about Franklin in Williamson County, and Jackson and Madison County. This latter area is of especial interest because of the rapid extension of improved highways, the study of soils of the Bureau of Soils of the Department of Agriculture, and questions of drainage along the Deer Creek.

In Virginia an area of 250 square miles was mapped in detail over the old reconnaissance surveys near Natural Bridge and Buchanan. An area of equal extent was completed near Hampton and Newport News, which it is expected will be of much interest, not only in connection with the Jamestown Exposition, but chiefly for studies by the War Department of defences of the Chesapeake and the Potomac River.

In West Virginia co-operation with the State Geologist, Dr. I. C. White, resulted in an unusually large amount of completed mapping. Seven atlas sheets of 225 square miles each was surveyed in the western portion of the State. These are especially needed now in connection with the rapid development of oil, gas and coal in that region. This season's work completes the map of West Virginia, excepting an area of about 50 square miles near Berkeley Springs.

In Wisconsin two parties were maintained for the season, one in the mapping of an area of 220 square miles about Cross Plains, which is just west of Madison, and the other in Monroe County near Sparta. The results of the first area will be especially important to the State Geologist and to the University of Wisconsin, and the second in connection with studies of the development of the mineral resources of western Wisconsin.

The topographic surveys of the United States Geological Survey have been pushed forward in the west at a rate about equal to that of previous years, with the exception of the work in the areas covered by forest reservations. By agreement with the chief of the Bureau of Forestry this year, the larger portion of the sum appropriated to the survey of forest reserves was devoted to the preparation of working forest maps, and a correspondingly smaller amount of funds remained available for field surveys over unmapped areas.

The preparation of these working forest maps under the direction of the United States Geological Survey has made remarkable progress in a relatively short period of time. The maps are compiled primarily from the existing topographic maps of the Geological Survey in conjunction with the records of the land surveys. The recent results of topographic surveying, as well as the reconnaissance work done by the old Powell, Hayden, Wheeler and King surveys, are compiled and adjusted to the land survey work in such manner as to fix as definitely as possible the relations of the topographic features to the land lines. This work is reproduced on the large scale of two inches to one mile. The results are photolithographed and distributed, through the Bureau of Forestry, to forest supervisors and rangers. By these the working maps are used in plotting the different varieties of timber and the extent of each variety, also in recording facts as to probable ownership and occupation of cleared lands, the division of cleared lands into grazing, agricultural, or barren land, the record of permits for lumbering and grazing, and other essential facts connected with forest supervision and management. All such working maps have been prepared for nearly half the total area of reserves, which aggregate in all over 100,000,000 acres, and they have been completed for a number of the larger reserves.

The feature of the topographic mapping of the past year in the west was the continuation of reconnaissance work on a scale of four miles to one inch and with elevations shown by contours of 200 ft. intervals in some of the larger unmapped portions of the United States. A year ago this work was commenced in the Amargosa Desert country, at which time about 9,000 square miles were mapped in southwestern Nevada and southeastern California. In the course of this work one atlas sheet covering a square degree was completely mapped, and portions of three others partially mapped. During the past season this work has been continued in view of the great economic importance of this region, which includes not only the borax deposits of the Desert, but such exceedingly important gold developments as those found about Bullfrog, Goldfield and Tonopah. Two thousand square miles of the area of the Las Vegas four-mile sheet, chiefly in Lincoln County, Nevada, have been mapped in this manner this year, and it is hoped that the entire sheet may be completed this season.

The same class of reconnaissance work was commenced in eastern Montana on the upland between the Missouri and Yellowstone Rivers, where little knowledge is available concerning the topography, and yet this latter is of interest in connection with projects for irrigation. A degree atlas sheet covering an area of nearly 4,000 square miles is being surveyed in eastern Dawson County, and there have been completed so far about 2,000 square miles of this area. This reconnaissance work is of a kind done in the earlier years by the old Powell and Hayden Surveys, and in the first ten years of the present Geological Survey. Also, the same kind of work has been recently executed in some of the undeveloped parts of Alaska. The unsurveyed area of the Far West is so vast that the present progress of detailed topographic mapping precludes the securing, in entirety, of essential topographic data for many years, because of the present rate of appropriations. It has, therefore, seemed wise to fill up hastily the unknown areas, extending meanwhile more detailed mapping in those portions of the west in which important developments, such as mining, irrigation, forestry, etc., may be in actual progress.

In Montana, in addition to the reconnaissance surveying, an area of about 600 square miles has been mapped in Granite and Ravalli Counties. This is on the two-mile scale and with 100 ft. contours in the rougher and less-known portions of the Rocky Mountain region.

In South Dakota topographic surveys on a scale of one mile to one inch have been extended over an area of about 125 square miles in Butte County. This mapping has been in progress for several years in the Black Hills and north thereof, the purpose being chiefly to secure detailed maps of the areas to be irrigated by the Belle Fourche project.

In Nevada, in addition to the reconnaissance work about Las Vegas in Lincoln County, a topographic map has been made on a large scale in White Pine County, about Ely, with a view to the study of the economic resources in precious metals. This map is on a scale of 2,000 ft. to 1 inch and covers a small area of approximately 25 square miles.

In Oklahoma co-operation for topographic mapping has been begun with the State Bureau of Agriculture. As a result topographic mapping has been pushed with unusual activity in this newest of our States. Work has been in progress during the summer on nine separate atlas sheets, eight of which are on a scale of 1 mile to 1 inch, and one, in the extreme northeastern corner of the State, on the two-mile scale. On the larger scale the Agra atlas sheet has been surveyed in Payne and Lincoln Counties. The Mallon sheet, partially mapped in connection with Indian Territory surveys, has been completed; so has the Sac and Fox atlas sheet. The Shawnee quadrangle, chiefly in Lincoln County, has been completed. Some work has been done on the Prague, Romulus, Asher, and Luther quadrangles, all in Pottawatomie County.

While the topographic mapping of all the Indian Territory has now been completed, a good beginning has been made in the mapping of the sister territory of Oklahoma, which composes about half of the new State of that name.

In Colorado the Loveland one-mile atlas sheet, and the Ft. Collins one-mile sheet, have been completed. About 500 square miles of the Livermore two-mile atlas sheet in Larimer County have been mapped. A large amount of re-survey of the old reconnaissance work on the Colorado Springs atlas sheet has been completed; also the Pikes Peak special one-mile atlas sheet with 50 ft. contours has been completed.

In Wyoming a small corner of the Medicine Bow two-mile atlas sheet, left unfinished last season, has been completed. The Fremont Peak two-mile atlas sheet, just southeast of the Yellowstone National Park, was completed, covering an area of nearly 1,000 square miles.

In New Mexico the Gallina quadrangle, chiefly in Rio Arriba County, has been more than half mapped. The scale of this work is 2,000 ft. to one inch. It lies in the higher mountains just northwest of Santa Fé.

In Washington two areas were under survey; the Zilla quadrangle, chiefly in Yakima County, on the two-mile scale, had about 500 square miles of its area mapped. In Whatcom County the Sumas quadrangle, on the one-mile scale, had about 150 square miles of its area mapped.

In Oregon topographic surveying was executed in co-operation with the State, three quadrangles being under survey, all on the two-mile scale. The Ironside Mountain quadrangle in Grant and Baker Counties was about half mapped. A small area of mapping was completed on the Mt. Hood Special in the Bull Run Reservation. In Morrow County about 600 square miles of the Wells Spring quadrangle were surveyed.

In Texas the survey of three quadrangles is under way and will be continued during the winter. The Texarkana quadrangle has been partially mapped and a good beginning has been made in the survey of the San Marcos quadrangle. Additional work in this State is expected to be taken up as the winter advances.

In Utah the Marsh Peak quadrangle, already partially mapped, this year had its survey completed. This is on the one-mile scale and lies in Uinta County.

In California a very large amount of topographic surveying was in progress because of the funds made available by co-operation with the State. Much of this work was in the Sacramento Valley in lower San Joaquin County, where it can be utilized in connection with the work of the State Debris Commission. It will also be of great value in connection with problems for the reclamation of swamps and for irrigation. The work of the year included the mapping of Elmira, Karquinez, Clarksburg, Rio Vista and Montezuma atlas sheets, chiefly in Solano County, with small portions lying in Yolo and San Joaquin Counties. Some detailed work was done on the Yosemite Special sheet in Mariposa County. This work was on the scale of 2,000 ft. to 1 inch. In Kern and Tulare Counties the Kernville quadrangle on the two-mile scale, had its area completely mapped, covering a total of 1,000 square miles.

AN ETHNOLOGIST IN EAST GREENLAND.

Dr. W. Thalbitzer, who has recently returned from a long visit to East Greenland, where he has been studying the natives and their language, has written an account of his sojourn among them which appears in *Petermanns Mitteilungen* (No. XI, 1906). From June 1, 1905, when his wife and he sailed for Greenland, they were entirely out of touch with the rest of the world. Angmagsalik, the only inhabited place on the east coast, is visited by a ship only once a year, and this ship, with its postal service established by Denmark in 1894, makes the voyage not directly from Europe but after touching on the west Greenland coast.

Dr. Thalbitzer landed from Denmark in the Egedesminde colony on the west coast, below 69° N., and lived there for two months until the steamer *Godthaab* sailed for East Greenland on Aug. 17. His wife took with her a west Greenland Eskimo woman as a servant, the first native woman of that coast to visit the East Coast Eskimos. The weather was very stormy, but in fourteen days the vessel lay off Angmagsalik in about 65° 30′ N. The polar current, packed with ice, was between them and the coast, and seemed to be unusually wide for the time of year. On the first day they lay about 30 kilometers from the land, but the position of the ice changed every day and for eight days the vessel was from 20 to 100 kilometers off shore. A favourable opportunity was improved on the ninth day to make way through the ice to the coast.

Angmagsalik derives its name from a large fiord to the north of Cape Dan, which, in the native speech, is called Ammattalik, meaning the place of the ammattä or caplin (*mallotus villosus*). The Danish Government established a trading station here in 1894 upon